

Original Research Article

Study of correlation of various metabolic abnormalities in patients of metabolic syndrome with abnormal thyroid functions and ultrasonography from Central India

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Received: 15 January 2021

Accepted: 11 February 2021

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ABSTRACT

Background: Metabolic syndrome is a cluster of various clinical and biochemical abnormalities. The thyroid hormone has influence on almost each and every cell of various organs in the body. Its deficiency or excess is likely to have various metabolic abnormalities and structural changes in thyroid gland may correlate with abnormal thyroid function test.

Methods: This cross sectional observational study was conducted in 100 consecutive patients of metabolic syndrome from October 2013 to October 2014 at MGM medical college and MY hospital Indore, Madhya Pradesh, India from one year of study duration and both outdoor and in patients were included in this study.

Results: In this study, 24 (24%) patients were pre-hypertensive. A 42 (42%) and 13 (13%) patients had stage I and stage II hypertension respectively. 78 (78%) patients had FBS more than 100 mg/dl and out of these patients, 61 patients had DM type 2 with FBS more than 125 mg/dl. TG was more than 150 mg/dl in 65 (65%) patients. Serum HDL level was low in 30 males and 52 females. USG thyroid findings in patients with thyroid dysfunction (24), were within normal limit, thyroiditis, thyroid adenoma, benign thyroid nodule, multinodular goiter, colloid cyst, and neoplastic lesion in 62.5%, 8.3%, 8.3%, 4.2%, 8.3%, 4.2%, and 4.2% respectively.

Conclusions: Prevalence of thyroid dysfunctions is more common in metabolic syndrome patients. All metabolic syndrome patients can be evaluated by thyroid function tests and ultrasonography to diagnose thyroid dysfunctions in early stages.

Keywords: Hypertension, Multinodular goiter, Metabolic syndrome, Thyroid dysfunction, Thyroiditis

INTRODUCTION

It is a well known fact that patients with metabolic syndrome (MS) are at a high risk for developing cardiovascular disease and other co-morbidities as well as incidence of premature death several times compared to normal population.¹ The chief culprit responsible for the MS is underlying insulin resistance.² People with MS are at an increased risk of atherosclerotic cardiovascular

disease and type 2 diabetes.³ The thyroid hormone has influence on almost each and every cell of various organs in the body. Its deficiency or excess is likely to have various metabolic abnormalities.⁴ Additionally, thyroid disease, especially overt hypothyroidism, is associated with atherosclerotic cardiovascular disease.⁵ Since MS and thyroid dysfunction are independent risk factors of atherosclerotic cardiovascular disease (CVD), the concurrent existence of the two will substantially increase

the risk of CVD. Several studies have shown a significant association which links MS with subclinical and overt hypothyroidism and the association seems to be more in females.^{6,7}

In a study done by Uzunlulu et al at Japan they have analysed the prevalence of sub clinical hypothyroidism (SCH) among 220 MS patients. They found that SCH was 16.4% prevalent in MS patients. One sixth of MS patients had SCH and more prevalent in female gender.⁶ In a study from Nepal, Chandra L et al found that the MS was prevalent in 21.1% of thyroid dysfunction patients. They have assessed the association of MS and its components with thyroid dysfunction in 100 female patients. This study found that the prevalence of overall MS was 32%, more in euthyroid group (21/48) than hyperthyroid group (5/24) and hypothyroid group (6/28).⁷ Lin et al in a study in Chinese population, observed lower free thyroxine levels in patients of metabolic syndrome.⁸

As metabolic syndrome and hypothyroidism are independent risk factors for the same disease process, namely cardiovascular disease, it is possible that patients suffering from both these disease entities may have a compounded risk. Current study is an effort to investigate the proposed association between these two disease entities and to identify the factors that increase the risk of this association.

METHODS

Study design

Presented study was a cross sectional, observational, and descriptive study of assessment of thyroid dysfunction in metabolic syndrome patients. The study was conducted from October 2013 to October 2014.

Study subjects

Patients diagnosed as metabolic syndrome by Asian Indian guidelines and fulfilling inclusion and exclusion criteria attending M. Y. hospital general medicine OPD, diabetes and cardiology OPD and medicine wards were included. 100 cases were included in the study.

Selection of study subjects

Study subjects were selected on the basis of Asian Indian guidelines, subjects who fulfilled any 3 out of 5 under mentioned guidelines were selected. Central obesity; defined as waist circumference with specific values (for south Asians: ≥ 90 cm for men and ≥ 80 cm women. Raised triglycerides; >150 mg/dl (1.7 mmol/l) or specific treatment for this lipid abnormality. Reduced HDL cholesterol; <40 mg/dl in males, <50 mg/dl in females, or specific treatment for this lipid abnormality. Raised blood pressure; systolic BP >130 and/or diastolic BP >85 mmHg or treatment of previously diagnosed

hypertension. Raised fasting plasma glucose; (FPG) >100 mg/dl, or previously diagnosed type 2 diabetes mellitus.

Inclusion criteria

Inclusion criteria for current study were; patients more than 18 years and less than 60 years of age were included in the study. This is because patients more than 60 years have other associated co-morbidities. Both males and females were included in this study.

Exclusion criteria

Exclusion criteria for current study were; age less than 18 years and more than 60 years, seriously ill patients, patients with multi system disease and malignancy, patients suffering from congestive heart failure, acute or chronic renal or liver disease, pregnant women, known case of hypothyroidism and hyperthyroidism and drugs known to alter levels of thyroid hormones and lipid levels.

Procedure

Patient's bio data was noted as per proforma. The presenting complaints pertaining to thyroid dysfunction were enquired into viz. swelling in the neck, chest pain, and palpitations. History of heat or cold intolerance, weight gain or weight loss, constipation or diarrhoea, fatigability, skin, and hair changes, menstrual disturbances, sleep disturbances and symptoms related to MS.

Statistical methods and analysis

The statistical software namely SPSS 15.0 Stata 8.0 and Graph Pad were used for the analysis of the data. Microsoft word and excel software have been used to generate graphs, tables etc. Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on mean (SD) (minimum-maximum) and results on categorical measurements are presented in number (%). Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups. Chi-square test is used for quantitative data by 2x2 contingency table. Pearson correlation coefficient has been used for finding of SCH cases, $p < 0.05$ was considered as statistically significant, $0.05 < p < 0.10$ was considered as suggestive significant, $0.01 < p < 0.05$ was considered as moderately significant and $p < 0.01$ was considered as strongly significant.

RESULTS

In current study, among the 100 patients included in our study, 40 patients were male and 60 were female. Patients were categorized on basis of BP, out of 100 patients, 10 (10%) patients had normal BP, 24 (24%) patients were pre-hypertensive, 42 (42%) patients had stage one

hypertension, and 13 (13%) patients had stage 2 hypertension (Table 1).

Table 1: Distribution of patients according to blood pressure.

Blood Pressure	N (%)
Normal	10 (10)
Pre hypertension	24 (24)
Stage 1 hypertension	42 (42)
Stage 2 hypertension	13 (13)
Isolated systolic hypertension	11 (11)
Total	100 (100)

BP was more than 130/85 mmHg in 71 (71%) patients with metabolic syndrome, diabetes mellitus was found in 61 (61%) patients, triglycerides was more than 150 mg/dl in 65 (65%) patients, HDL was lower side in 82 (82%) patients and obesity was found in 81 (81%) patients (Table 2).

Table 2: Distribution of patients according to metabolic syndrome components.

Characteristics	Number of patients	
Blood pressure (mmHg)	≥130/85	71
	<130/85	29
Fasting blood sugar (mg/dl)	<100	22
	100-125	17
	≥126	61
Triglycerides (mg/dl)	≥150	65
	<150	35
HDL (mg/dl)	Low	82
	Normal	18
Obesity	Yes	81
	No	19

In 24 patients with thyroid dysfunction, majority 15 (62.5%) had normal ultrasonography of thyroid. In 2 cases each of thyroiditis, thyroid adenoma, and multinodular goiter was found and in 1 case each of benign thyroid nodule, colloid cyst and neoplastic mass was present (Table 3).

In 76 patients with euthyroidism, majority of patients 59 (77.6%) had normal USG thyroid. In 5 cases (6.6%) each of benign thyroid nodule and colloid cyst, 2 cases (2.6%) each of solitary thyroid nodule and thyroid adenoma and 3 cases (3.94%) of multinodular goiter was found (Table 4).

DISCUSSION

The metabolic syndrome is a cluster of metabolic abnormalities wherein people are obese and have hypertension, high triglyceride level, low high density lipoprotein cholesterol, and abnormal fasting glucose

levels.³ People with MS are high risk for developing cardiovascular disease and type 2 diabetes. Hypothyroidism is associated with lipid abnormalities like high triglycerides and low high density lipoproteins, weight gain, glucose intolerance and hypertension.⁹ Thus hypothyroidism mimics the parameters of MS. Current study was conducted in 100 cases of MS, attending diabetes and cardiology OPD and those admitted in wards in M. Y. hospital Indore. In current study, Asian Indian guidelines were used as criteria for metabolic syndrome. In 78% patient impaired fasting glucose was found. This is higher than other studies as the cut off used in our study was 100 mg/dl as compared the other studies which had a cut off of fasting blood glucose >110 mg/dl. In addition, as most of our patients were selected from diabetes OPD there was more number of diabetics included in the study.

In this study, USG thyroid was done in all patients, in 74% patient USG thyroid was normal, 2% patients had thyroiditis, 6% patients had benign thyroid nodules, 2% had solitary thyroid nodule, 4% had thyroid adenoma, 5% had multinodular goiter, 6% had colloid cyst, and 1% had neoplastic mass. USG thyroid could be considered as a good screening tool as shown in following studies. In a study by Shin et al in 204 SCH patients who were initially underwent thyroid USG were analysed and given a low dose of levothyroxine for a mean of 6.94 months.¹⁰ Outcome was determined by the normalization or sustained elevation of serum TSH, and evaluated according to the presence of DT on USG and serum anti TPO antibody or thyroglobulin antibody. Sustained TSH elevation after levothyroxine replacement was more frequent in patients who initially showed DT on USG, regardless of thyroid autoantibody level. Ultrasonography morphology had a higher negative predictive value (81.8%) compared with the absence of anti TPO antibody (73.9%) of anti thyroglobulin antibody (73.7%) and a similar positive predictive value (48.9%) to that of thyroid autoantibodies (46.8% for TPOAb and 50% for TgAb) in the outcome prediction of SCH. Thyroid USG may provide valuable information on the course of SCH, and DT pattern can serve as a prognostic factor when combined with other known parameters.

In a study done in a random population high-frequency USG examination of the thyroid was performed in 253 subjects (130 women and 5 men; age range, 19-50 years) that were randomly selected from the population in an area of Finland where goiter is not endemic.¹¹ Thyroid echo abnormalities were detected in 69 subjects (27.3%). Prevalence of abnormalities increased with age, and women showed more lesions than did men in each of the 3 decades. The abnormality was solitary in 39 subjects (57%), multiple in 15 (22%), and diffuse in 15 (22%). Of the 68 individual nodules, 48 (70%) were smaller than 1 cm in diameter. Anechoic rounded nodules 1-5 mm in diameter were found in 28 subjects. Fine-needle aspiration biopsy was performed in 30 subjects. Cytologic examination revealed no unequivocal

malignancies. In eight subjects (3.2%) with a diffuse echo abnormality, cytologic evaluation indicated lymphocytic thyroiditis. It is concluded that the prevalence of thyroid

echo abnormalities in a randomly selected adult population is rather high, a fact that supports use of a conservative approach to these types of findings.

Table 3: USG thyroid findings in patients with metabolic syndrome who had abnormal thyroid profile.

USG thyroid	Normal N (%)	Thyroiditis N (%)	Thyroid adenoma N (%)	Benign thyroid nodule N (%)	Multinodular goiter N (%)	Colloid cyst N (%)	Neoplastic mass N (%)
Thyroid dysfunction (n=24)	15 (62.5)	2 (8.3)	2 (8.3)	1 (4.2)	2 (8.3)	1 (4.2)	1 (4.2)

Table 4: USG thyroid findings in patients with metabolic syndrome who had normal thyroid profile.

USG thyroid	Normal N (%)	Thyroid adenoma N (%)	Benign thyroid nodule N (%)	Multinodular goiter N (%)	Colloid cyst N (%)	Solitary thyroid nodule N (%)
Euthyroid (n=76)	59 (77.6)	2 (2.6)	5 (6.6)	3 (3.94)	5 (6.6)	2 (2.6)

In current study, most common symptom in hypothyroid patients was neck swelling in 100% cases while cold intolerance, weight gain, and tiredness seen in 75% cases while constipation and hoarse voice was seen 50% cases. As we had only 4 hypothyroid patients in the study, we had high percentage of clinical features and these results do not necessarily apply to the general population. In euthyroid patients, tiredness and weight gain was seen in 26.31% patients, cold intolerance in 19.72% cases and in subclinical hypothyroid cases 31.57% cases had tiredness while 26.31% cases had weight gain and cold intolerance.

In a study by Khurram et al the symptoms that were highly suggestive of hypothyroidism, increased sensation to cold, lethargy, constipation weight gain, appetite loss, depression, menorrhagia, and hoarseness.¹² Tiredness was seen in 60.4% in hypothyroid and euthyroid patients. Weight gain was seen in 44.9% hypothyroid patients and 8.4% euthyroid patients. Cold intolerance was seen in 50.9% hypothyroid and 7.4% euthyroid patients.

In current study, there was a significant negative correlation between TSH and HDL levels. We did not obtain any correlation between TSH, T4 and other lipid parameters or any other metabolic syndrome parameters. This may be because our study included only metabolic syndrome and majority had dyslipidemia.

In a study conducted by Asvold et al they concluded that, within the reference range range of TSH, there was a linear and significant ($p < 0.001$) increase in total serum cholesterol, LDL cholesterol and non HDL cholesterol and triglycerides, and a linear decrease ($p < 0.001$) in HDL cholesterol with increasing TSH.¹³ Sub-group analyses showed statistically significant associations for all lipids in men above 50 years of age, and for triglycerides in all age groups. For women, associations were statistically significant in all age groups except for HDL cholesterol

in women below 50 years of age. The associations with triglycerides and HDL cholesterol were stronger among overweight than normal weight individuals.

CONCLUSION

Prevalence of hypothyroidism and SCH is more common in metabolic syndrome patients. Waist circumference and BMI were significantly high in subclinical hypothyroid patients as compared to euthyroid patients.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Upadhyay S, Jhavar D, Patel NK, Chouhan R, Khalwadekar A. Study of correlation of various metabolic abnormalities in patients of metabolic syndrome with abnormal thyroid functions and ultrasonography from Central India. *Int J Adv Med* 2021;8:439-43.